WORLD INTELLECTUAL PROPERTY ORGANIZATION International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6:		THE THE PLANT (PC1)		
E21B 43/10, 33/10	A1	(11) International Publication Number:	WO 99/02818	
		(43) International Publication Date:	21 January 1999 (21.01.99)	

(21) International Application Number:

PCT/GB98/02066

(22) International Filing Date:

13 July 1998 (13.07.98)

(30) Priority Data:

9714651.8

12 July 1997 (12.07.97)

GB

(71) Applicant (for all designated States except US): PETROLINE WELLSYSTEMS LIMITED [GB/GB]; Offshore Technology Park, Claymore Drive, Bridge of Don, Aberdeen AB23 8GD (GB).

(72) Inventor; and

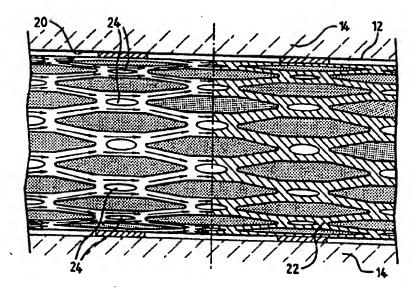
(75) Inventor/Applicant (for US only): METCALFR, Paul, David [GB/GB]; North Wing, Bucklerburn Steading, Peterculter AB14 0NP (GB).

(74) Agents: McCALLUM, William, Potter et al.; Cruikshank & Fairweather, 19 Royal Exchange Square, Glasgow G1 3AE (GB). (81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, IP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SI, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

(54) Title: DOWNHOLE TUBING



(57) Abstract

There is provided a downhole tubing scaling system (10) comprising a radially expandable slotted tubular body (16) carrying deformable material (22) on the exterior thereof; and a scal member (26) for location within the tubular body and for engaging an inner surface of said body. There is further provided a method of scaling a portion of a downhole bore, the method comprising locating a radially expandable slotted tubular body (16) carrying deformable material (22) on the exterior thereof in a bore, expanding the body radially into contact with the bore wall, and locating a scal member (26) within the body and radially extending the scal member to engage an inner surface of the body, so scaling a portion of the downhole bore.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albenia	ES	Spain	LS	Lesotho	SI	
AM	Amenia	PI	Pouland	LT	Litheania		Slovenia
ΑŤ	Austria	PR	Prance	i.u	Luxemboure	SK	Slovakia
AU	Australia	GA	Gabon	LV	Lavia	SN	Senegal
ΑZ	Azerbaijan	GB	United Kingdom	MC	Monaco	SZ.	Swaziland
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TD	Chad
BB	Barbados	GH	Ghana	MG		TG	Togo
BE	Bolgium	GN	Guinea	MIK	Madagascar The femore Versel	TJ	Tajikistan
B F	Burkina Faso	GR	Greece	TVA.	The former Yugoslav	TM	Turkmenistan
BG	Bulgaria	HU	Hungary	ML	Republic of Macedonia	TR	Turkey
BJ	Bonin	IE	Ireland	MIN	Mali	TT	Trialded and Tobago
BR	Brazil	IL	Israel	MIR	Mongolia	UA	Ukraine
BY	Belans	13	liceland	MW	Mauritania	UG	Uganda
CA	Canada	IT	Italy	MX	Malawi	US	United States of America
CF	Central African Republic	IP	Japan	NB.	Mexico	UZ	Uzbekistan
CC	Congo	KE	Kenya	NL	Niger	VN	Vict Nam
СН	Switzerland	KG	Kyrgyzstan	NO	Netherlands	VU	Yugoslavia
CI	Côte d'Ivoire	KP	Democratic People's		Norway	zw	Zimbebwe
CM	Cameroon		Republic of Korea	NZ	New Zealand		
CN	China	KR	Republic of Korea	PL PT	Poland		
CU	Cuba	KZ	Kazaksten .		Portugal		
CZ	Czech Republic	LC	Saint Lucia	RO RU	Romania		
DB	Germany	ŭ	Liechtenstein	SD	Russian Pederation		•
DK	Denmark	LK	Sri Lanka	SE	Sudan		•
EE	Estonia	LR	Liberia	SG	Sweden		•
				56	Singapore		•

DOWNHOLE TUBING

This invention relates to downhole tubing, a downhole tubing sealing system, and to elements of such a system. The invention also relates to a method of lining a bore and to a method for sealing downhole tubing.

5

10

15

20

25

In oil and gas extraction operations, a bore is drilled through the earth to intersect a hydrocarbonbearing formation which forms the hydrocarbon reservoir, allowing oil and gas from the reservoir to be transported to the surface. The bore intersecting the reservoir is typically lined with steel casing which is cemented in the bore. A perforating gun is then lowered into the bore and detonated to form perforations which extend through the casing and the cement and into the formation. Typically, sets of perforations are provided at intervals along the casing, and the perforated casing may extend for several thousand metres through the formation. To control the flow of oil from the formation inflatable packers may be provided to isolate selected sets of perforations and thus isolate the corresponding portions of the formation.

It has recently been proposed that such cemented and perforated casing be replaced by expandable slotted tubing, such as described in W093\25800 (Shell Internationale Research Maatschappij B.V.). Such tubing comprises lengths of tube which have been machined to create a large number of overlapping longitudinal slots. The tube is radially expanded, while downhole, into contact with the bore wall,

2

the slots extending to create diamond-shaped apertures. The expanded tube thus provides support for the bore wall while allowing oil to flow into the bore through the extended slots.

It is among the objectives of embodiments of the present invention to provide a system which allows a section of bore wall lined with such expanded tubing to be sealed or isolated, and thus facilitate control of the flow of oil from a hydrocarbon reservoir.

10

15

20

25

According to one aspect of the present invention there is provided downhole tubing comprising a radially expandable slotted tubular body carrying deformable material on the exterior thereof.

According to a further aspect of the present invention there is provided a downhole tubing sealing system comprising a radially expandable slotted tubular body carrying deformable material on the exterior thereof, and a seal member for location within the body and for engaging an inner surface of the body.

In use, the tubular body is located in a bore and expanded radially into contact with the bore wall. The presence of the deformable material on the exterior of the body ensures that full contact is achieved between the outer surface of the body and the bore wall. The sealing member is then activated to engage the inner surface of the body and provides a sealing contact therewith. The length of the seal member and/or the location of the seal member in the body is selected such that none of the slots in the

3

body extend beyond both ends of the seal member; otherwise, fluid would be able to flow around the seal member by passing along the slots.

According to another aspect of the present invention there is provided a method of isolating a portion of a downhole bore, the method comprising the steps of:

5

10

15

20

25

providing a radially expandable slotted tubular body carrying deformable material on the exterior thereof;

locating the body in a bore and expanding the body radially into contact with the bore wall; and

locating a seal member within the body and radially extending the member to engage an inner surface of the body.

As used herein the terms "slots" is intended to encompass any holes or apertures which facilitate expansion of the body, including bores, slots or weakened areas which initially only extend part way through the body.

These aspects of the invention permit the complete sealing of a bore lined with expanded slotted tubing. Conventional expanded slotted metal tubing does not achieve a fluid-tight metal-to-rock contact: because the outer surface of the tubing tends to retain its original curvature, that is the curvature of the unexpanded tubing, not all of the outer surface contacts the bore wall following expansion. With the inner surface sealed, for example by a packer, there remains a small area S-shaped leak path between the tubing and the bore wall where the tubing is not in contact with the wall; this leak path may

5

10

15

20

PCT/GB98/02066

account for around 0.5% of the cross sectional area of a bore. However, with the present invention the deformable material on the outer surface of the body allows complete contact between the body and the bore wall and eliminates this leak path.

Preferably, the deformable material is an elastomer. Of course the deformable material will be selected to withstand handling and the conditions experienced downhole, for example the selected material preferably bonds to the body outer surface sufficiently to prevent erosion or degradation during installation, withstands the elevated temperatures experienced downhole (typically 130 - 180°C), and is resistant to crude oils, brines, acids and other fluids likely to be encountered downhole.

According to a further aspect of the present invention there is provided a method of lining a downhole bore, the method comprising the steps of:

providing a radially expandable slotted tubular body carrying deformable material on the exterior thereof; and

locating the body in a bore and expanding the body radially into contact with the bore wall.

These and other aspects of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

25 Figure 1 is a schematic sectional view of a downhole sealing system in accordance with an embodiment of the present invention, shown in a bore;

Figure 2 is an enlarged sectional view on line 2 - 2

5

10

15

20

of Figure 1; and

Figure 3 is an enlarged side view of the tubing of system of Figure 1, one half of the Figure illustrating the effect of the absence of a deformable material coating as provided in embodiments of the present invention.

The drawings illustrate a downhole tubing sealing system 10 in accordance with an embodiment of the present invention. The system 10 is shown, in Figure 1 of the drawings, in a drilled horizontal bore 12 which intersects an oil bearing formation or reservoir 14.

The system 10 includes tubing 16, similar to that as described in W093\25800 (Shell Internationale Research Maatschappij B.V.), which includes a large number of overlapping longitudinal slots 18. The tubing 16 is run into the bore 12 in unexpanded configuration and a mandrel then pushed up or pulled through the tubing 16 to expand the tubing radially outwards. The expansion is accommodated by the extension of the slots 18 to form the diamond shaped apertures as illustrated in Figure 3 of the drawings. As may be seen in Figure 2 of the drawings, the tubing 16 is expanded into contact with the bore wall 22, and thus provides support for the bore wall 20 while allowing oil to flow from the reservoir through the expanded slots 18.

25 The tubing 16 is formed of an appropriate metal, typically steel, and carries an external coating of a deformable material in the form of an elastomer 22. The provision of the elastomer coating allows the outer surface

6

of the tubing 16 to form a sealing contact with the bore wall 20, as described below.

5

10

15

20

25

On expansion of the tubing 16, the metal outer surface of the tubing tends to retain its original curvature, that is the curvature of the unexpanded tubing, as may be seen from Figure 2. As a result, in the absence of an elastomer coating 22, not all of the outer surface of the tubing would contact the bore wall 22 following expansion; metalto-rock contact would only be achieved at the contact points 24 as indicated in Figures 2 and 3. Thus, it may be seen that, in the absence of the elastomer coating, a small area S-shaped leak path would remain between the tubing and the bore wall where the tubing was not in contact with the However, in the present invention, differential wall. compression of the elastomer coating 22 ensures that there is an elastomer-to-rock contact around the circumference of the tubing (though of course not at the slots 18).

In the illustrated example the reservoir 14 has been isolated from the bore 12 by providing a packer 26 within the tubing 16, the packer providing a sealing contact with the interior of the tubing 16 over the length of the intersection of the bore 12 with the reservoir 14. The packer 26 is mounted on a tube 28 which allows fluid to flow past the isolated reservoir 14.

It will be apparent to those of skill in the art that the above-described embodiment provides numerous advantages over conventional cemented and perforated casing systems, and also other methods of sealing expanded slotted tubing, 5

10

such as providing an external isolation sleeve on the tubing. With the present invention, the whole length of the tubing may contribute to flow as all of the slots in the tubing are normally opened. Further, the internal sealing member or packer may be provided at any location in the tubing, and is thus adaptable to deal with any situation or problems that may arise in a bore.

It will also be clear to those of skill in the art that the above-described embodiment is merely exemplary of the present invention, and that various modifications and improvements may be made thereto, without departing from the scope of the present invention.

CLAIMS

10

20

- 1. Downhole tubing comprising a radially expandable slotted tubular body carrying deformable material on the exterior thereof.
- 5 2. The downhole tubing of claim 1 wherein said deformable material is an elastomer.
 - 3. The downhole tubing of claim 2 wherein said elastomer is selected to be resistant to high temperatures, and to crude oils, brines, acids, and other degradative fluids encountered downhole.
 - 4. A downhole tubing sealing system comprising the downhole tubing of claims 1 to 3, and a seal member for location within said body and for engaging an inner surface of said body.
- 5. A method of isolating a portion of a downhole bore, the method comprising the steps of:

providing a radially expandable slotted tubular body carrying deformable material on the exterior thereof;

locating said body in a bore and expanding said body radially into contact with the bore wall, and

locating a seal member within said body, and radially extending said member to engage an inner surface of said

body.

5

6. A method of lining a downhole bore, the method comprising the steps of:

providing a radially expandable slotted tubular body carrying deformable material on the exterior thereof; and locating said body in a bore and expanding said body radially into contact with the bore wall.

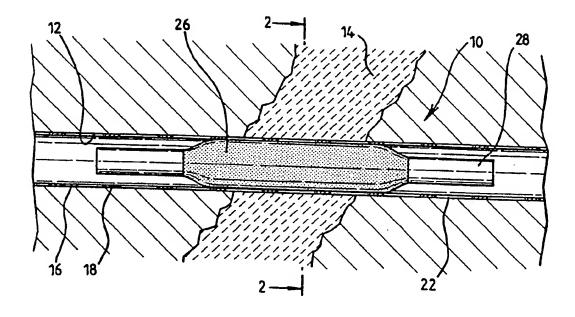


FIG.1

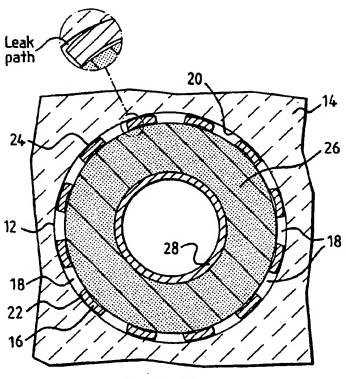
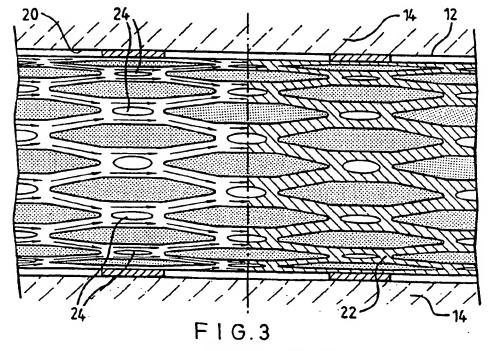


FIG.2



SUBSTITUTE SHEET (RULE 26)

INTERNATIONAL SEARCH REPORT

PCT/GB 98/02066

According to informational Patent Classification syntem (at our both national disabilication and IPC 8. PELES SEARCHED 9. PELES SEARCHED 176. 6 E218 Documentation searched (disabilication syntem (at owned by classification syntods) 176. 6 E218 Documentation searched other than minimum occumentation to the extent that such occurrents are included in the factor searched Electronic data base conducted during the informational search (name of data base and, where practical, search forms used) Electronic data base conducted during the informational search (name of data base and, where practical, search forms used) Electronic data base conducted during the informational search (name of data base and, where practical, search forms used) Electronic data base conducted during the informational search (name of data base and, where practical, search forms used) Electronic data base conducted during the informational search (name of data base and, where practical, search forms used) Electronic data base conducted during the informational search (name of data base and, where practical, search forms used) Electronic data base conducted during the informational search (name of data base and, where practical, search forms used) Electronic data base conducted during the informational search (name of data base and, where practical informational data base and and an administrational search (name of data base and an administrati	A. CLASS	SIFICATION OF SUBJECT MATTER			
Marinam gootunestation searched (classification system followed by classification symbols) IFC 6 E218 Documentation searched other than maximum gootuneratation to the extert that such documents are included in the fields searched Electronic data base consulted cluring the international search (name of data base and, where practical, search forms used) C. DOCUMENTS CONSIDERED TO BE RELEVANT Category* Citation of document, with indication, where appropriate, of the relevant passages X W 9 4 25655 A (DRILLFLEX) 10 November 1994 See page 5, line 30 – page 6, line 21 See page 9, line 26 – line 31 A US 3 746 091 A (GMEN ET AL.) 17 July 1973 I See column 7, line 7 – line 16 A US 3 3489 220 A (KINLEY) 13 January 1970 I see column 2, line 36 – line 55 See column 6, line 70 – line 75 A US 3 353 599 A (SWIFT) 21 November 1967 See column 6, line 70 – line 75 A US 3 3669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 June 1972 A US 3 669 190 A (SIZER E	IPC 6	E21843/10 E21833/10		•	
Marinam gootunestation searched (classification system followed by classification symbols) IFC 6 E218 Documentation searched other than maximum gootuneratation to the extert that such documents are included in the fields searched Electronic data base consulted during the infernational search (name of data base and, where practical, search terms used) C. DOCUMENTS CONSIDERED TO BE RELEVANT Category* Citation of document, with indication, where appropriate, of the relevant passages Riskmant to claim No. X W 94 25655 A (DRILLFLEX) 10 November 1994 See page 5, line 30 – page 6, line 21 See page 9, line 26 – line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 I See column 7, line 7 – line 16 A US 3 3489 220 A (KINLEY) 13 January 1970 I See column 6, line 70 – line 75 A US 3 353 599 A (SWIFT) 21 November 1967 See column 6, line 70 – line 75 A US 3 3669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 10	According	to International Patent Classification(IPC) or to both national cla	in the state of th		
Documentation searched client than tentimum documentation to the extent that such documents are included in the fields searched Electronic data base concuted during the international search (name of data base and, where practical, search forms used) C. DOCUMENTS CONSIDERED TO BE RELEVANY Collegory* Citation of document, with indication, where appropriate, of the relevant passages X W0 94 25655 A (DRILLELEX) 10 November 1994 See page 5, line 30 – page 6, line 21 See page 9, line 26 – line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 See column 7, line 7 – line 16 A US 3 489 220 A (KINLEY) 13 January 1970 See column 7, line 7 – line 16 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, line 71 – column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 B US 4 5 5 5 5 5 5 5	B. FIELDS	S SEARCHED			
Documentation searched client than minimum documentation to the extent that such documents are included in the felcts searched Electronic data base concuted during the international search (name of data base and, where practical, search forms used) C. DOCUMENTS CONSIDERED TO BE RELEVANY Category* Citation of document, with indication, where appropriate, of the relevant passages X W0 94 25655 A (DRILLELEX) 10 November 1994 See page 5, line 30 – page 6, line 21 See page 9, line 26 – line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 See column 7, line 7 – line 16 A US 3 489 220 A (KINLEY) 13 January 1970 See column 7, line 7 – line 16 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, line 71 – column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL.) 10 A US 3 669 190 A (SIZER ET AL	Minimum o	documentation searched (classification system followed by class	fication symbols)		
Electronic data base consulted during the infernational search (name of data base and, where practical, search (orms used) C. DOCUMENTS CONSIDERED TO BE PRILEVANT Category* Citation of document, with indication, where appropriate, of the relevant passages Risterant to claim No. X W0 94 25655 A (DRILLFLEX) 10 November 1994 see page 5, 1 line 30 - page 6, 1 line 21 see page 7, 1 line 25 - page 8, 1 line 5 see page 9, 1 line 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 see column 7, 1 line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 see column 2, 1 line 36 - 1 line 55 see column 6, 1 line 70 - 1 line 75 A US 3 353 599 A (SWIFT) 21 November 1967 see column 4, 1 line 71 - column 5, 1 line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 4,5 See abstract X Peter family members are Risked in smell. X Further documents are seed in the continuation of box C. X Peters family members are Risked in smell. X Further documents are seed on the continuation of box C. X Peters family members are Risked in smell. X Contracted they be price the government of the self-winding or which is cred to satisfact charmed. X Contracted they forced outside on protry claiming or which is cred to satisfact in the government. X Contracted they forced outside on protry claiming or which is cred to satisfact in the government. X Peters family members are Risked in smell. X Peters family members are Risked in smell. X Contracted they forced outside of another or other and self-winding or which is a cred to satisfact in the government or another or other windings or which is a cred to satisfact in the government or other windings or	1100	£518	,		
Electronic data base consulted during the infernational search (name of data base and, where practical, search (orms used) C. DOCUMENTS CONSIDERED TO BE PRILEVANT Category* Citation of document, with indication, where appropriate, of the relevant passages Risterant to claim No. X W0 94 25655 A (DRILLFLEX) 10 November 1994 see page 5, 1 line 30 - page 6, 1 line 21 see page 7, 1 line 25 - page 8, 1 line 5 see page 9, 1 line 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 see column 7, 1 line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 see column 2, 1 line 36 - 1 line 55 see column 6, 1 line 70 - 1 line 75 A US 3 353 599 A (SWIFT) 21 November 1967 see column 4, 1 line 71 - column 5, 1 line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 4,5 See abstract X Peter family members are Risked in smell. X Further documents are seed in the continuation of box C. X Peters family members are Risked in smell. X Further documents are seed on the continuation of box C. X Peters family members are Risked in smell. X Contracted they be price the government of the self-winding or which is cred to satisfact charmed. X Contracted they forced outside on protry claiming or which is cred to satisfact in the government. X Contracted they forced outside on protry claiming or which is cred to satisfact in the government. X Peters family members are Risked in smell. X Peters family members are Risked in smell. X Contracted they forced outside of another or other and self-winding or which is a cred to satisfact in the government or another or other windings or which is a cred to satisfact in the government or other windings or					
Electronic data base consulted during the infernational search (name of data base and, where practical, search (orms used) C. DOCUMENTS CONSIDERED TO BE RELEVANT Category* Citation of document, with indication, where appropriate, of the relevant passages Riskwant to claim No. X W0 94 25655 A (DRILLFLEX) 10 November 1994 See page 5, line 30 - page 6, line 21 See page 7, line 25 - page 8, line 2 See page 9, line 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 See column 7, line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 See column 2, line 36 - line 55 See column 6, line 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 14 June 1972 A US 3 669 190 A (SIZER ET AL.) 15 June 1972 A US 3 669 190 A (SIZER ET AL.) 16 June 1972 A US 3 669 190 A (SIZER ET AL.) 16 June 1972 A US 3 669 190 A (SIZER ET AL.) 16 June 1972 A US 3 669 190 A (SIZER ET AL.) 17 June 1972 A US 3 669 190 A (SIZER ET AL.) 18 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A US 3 669 190 A (SIZER ET AL.) 19 June 1972 A U	Documenta	ation searched other than minimum documentation to the extent	that such documents are included in the fields a	arched	
C. DOCUMENTS CONSIDERED TO BE RELEVANT Category** Citation of document, with indication, where appropriate, of the relevant passages X W0 94 25655 A (DRILLFLEX) 10 November ,1994 See page 5, line 30 - page 6, line 21 See page 7, line 25 - page 8, line 5 See page 9, line 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 See column 7, line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 See column 2, line 36 - line 55 See column 6, line 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 US Petert family members are 864ed in annex. The followers to be of pariodar relevance in collision of the relevance in collision of the pricipal collision of the series of pariodar relevance in collision of the series of pariodar servence in collision of the series of pariodar servence in collision of the series of pariodar servence in collision of the servence in the distinguity of the international servence in the distinguity of the pariod servence in the distinguity of the international search in the servence in the distinguity of the international search in the servence in the distinguity of the international search in the servence in the distinguity of the international search in the servence in the distinguity of the international search international search international search in the servence in the servence in the servence in the servence in the s					
C. DOCUMENTS CONSIDERED TO BE RELEVANT Category* Citation of document, with indication, where appropriate, of the relevant passages Ridevant to claim No. X W0 94 25655 A (DRILLFLEX) 10 November .1994 See page 5, line 30 – page 6, line 21 See page 7, line 25 – page 8, line 5 See page 9, line 26 – line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 See column 7, line 7 – line 16 A US 3 489 220 A (KINLEY) 13 January 1970 See column 2, line 36 – line 55 See column 6, line 70 – line 75 A US 3 353 599 A (SMIFT) 21 November 1967 See column 4, line 71 – column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 19	Florence				
Category* Citation of document, with indication, where appropriate, of the relevant passages X	Clockly IC	usua base consumed during the international search (name of da	its base and, where practical, search terms used	1)	
Category* Citation of document, with indication, where appropriate, of the relevant passages X					
Category* Citation of document, with indication, where appropriate, of the relevant passages X					
Category* Citation of document, with indication, where appropriate, of the relevant passages X W0 94 25655 A (DRILLFLEX) 10 November 1994 See page 5, 1ine 30 - page 6, 1ine 21 See page 7, 1ine 25 - page 8, 1ine 5 See page 9, 1ine 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 See column 7, 1ine 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 See column 6, 1ine 70 - line 75 See column 6, 1ine 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, 1ine 71 - column 5, 1ine 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190	C DOCUM	ENTS CONSIDERED TO DE TO			
X WO 94 25655 A (DRILLFLEX) 10 November 1994 1-3,6 see page 5, line 30 - page 6, line 21 see page 7, line 25 - page 8, line 5 see page 9, line 26 - line 31 1 1 1 1 1 1 1 1 1					
See page 5, line 30 - page 6, line 21 see page 7, line 25 - page 8, line 5 see page 9, line 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 see column 7, line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 see column 2, line 36 - line 55 see column 6, line 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 see column 4, line 71 - column 5, line 30 US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (Challet of document, with indication, where appropriate, of the	o relevant passages	Relevant to claim No.	
See page 9, line 25 - page 8, line 5 see page 7, line 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 see column 7, line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 see column 2, line 36 - line 55 see column 6, line 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 see column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 6	X	WO 94 25655 A (DRILLELEY) 10 N			
See page 9, line 25 - page 8, line 5 see page 9, line 26 - line 31 A US 3 746 091 A (OWEN ET AL.) 17 July 1973 see column 7, line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 see column 2, line 36 - line 55 see column 6, line 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 see column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A June		see page 5. line 30 - page 6	lovember 1994	1-3,6	
A US 3 746 091 A (OWEN ET AL.) 17 July 1973 See column 7, line 7 - line 16 A US 3 489 220 A (KINLEY) 13 January 1970 See column 2, line 36 - line 55 See column 6, line 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET		see page 7. line 25 - page 8	line 5		
A US 3 489 220 A (KINLEY) 13 January 1970 A US 3 353 599 A (SWIFT) 21 November 1967 See Column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A June 1972		see page 9, line 26 - line 31	3		
A US 3 489 220 A (KINLEY) 13 January 1970 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A document defining the general state of the art which is not considered to be of particular relevance For earlier document by published on or after the hiernational illing date or which is cited to satisfies the publicational action or other special reason (as specified) C document interring to an oral disclosure, use, surpticion or other special reason (as specified) C document interring to an oral disclosure, use, surpticion or other special reason (as specified) C document interring to an oral disclosure, use, surpticion or other special reason (as specified) To document published prior to the remaintional lifting date but later than the priority date claimed 19 October 1998 Name and meaning address of the ISA European Patent Office, PB, 5818 Patentian 2 Name and meaning address of the ISA European Patent Office, PB, 5818 Patentian 2	Α	IIS 3 746 091 A (OUEN ET AL.)			
A US 3 489 220 A (KINLEY) 13 January 1970 See column 2, line 36 — line 55 See column 6, line 70 — line 75 A US 3 353 599 A (SWIFT) 21 November 1967 See column 4, line 71 — column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 A See abstract Y Patent family members are based in the continuation of box C. X Patent family members are based in annex. Y Special categories of cited documents: A document defining the general state of the an which is not considered to be of particular relevance. Y and is document but published on or after the international filling date 1 document which may throw doubts on protein continuation or other process in the special reason (as specified) Y document of particular relevance; the claimed invention and continuation and exclusive such in the occurrent of a taken alone of the relevance of particular relevance; the claimed invention cannot be considered to be of particular relevance; the claimed invention continue with the continue of the same patent family Dide of the actual completion of the international search 19 October 1998 Seme and mesting address of the ISA European Patent Office, PB. 5818 Patentlan 2 N2280 HY Bloom's	••	See Column 7. line 7 - line 16	1		
See Collumn 2, 11ne 36 - 11ne 55 see Collumn 6, 1ine 70 - 1ine 75 US 3 353 599 A (SWIFT) 21 November 1967 see collumn 4, 1ine 71 - collumn 5, 1ine 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 4,5 Further documents are listed in the continuation of box C. Petent family members are listed in arnex.					
See Column 6, line 70 - line 55 see Column 6, line 70 - line 75 A US 3 353 599 A (SWIFT) 21 November 1967 see column 4, line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 4,5 See abstract -/ X Petent family members are listed in the continuation of box C. X Petent family members are listed in annex. -/ Year document defining the general state of the art which is not consistered to be of particular relevance: **Coursent defining the general state of the art which is not consistered to be of particular relevance: **Coursent which may throw doubts on priority claim(s) or which a cited to establish the publication date of another relation or other special reason (as specified) **Coursent which may throw doubts on priority claim(s) or which a cited to establish the publication date of another relation to other special reason (as specified) **Coursent which may throw doubts on priority claim(s) or which a cited to establish the publication date of a nother other special reason (as specified)	Α	US 3 489 220 A (KINLEY) 13 Jan	uary 1970	1	
A US 3 353 599 A (SWIFT) 21 November 1967 see column 4. line 71 - column 5, line 30 A US 3 669 190 A (SIZER ET AL.) 13 June 1972 X See abstract X Petent family members are sated in the continuation of box C. X Petent family members are sated in annex. Y Special categories of cited documents: A document defining the general state of the art which is not considered to be of panicular relevances E earlier document but published on or after the hismational fling date or priority date and not in contrict with the application but cited to understand the principle or theory underlying the invention considered to be of panicular relevance; the claimed invention cannot be considered to relevance in the course of panicular relevance; the claimed invention cannot be considered to rivel or cannot be considered to rivel an inventive step when the document is taken alone of the constitution of the constitut		See Column 2, line 36 - line 5	01umn 2, 11ne 36 - 11ne 55		
See Column 4, line 71 - column 5, line 30 US 3 669 190 A (SIZER ET AL.) 13 June 1972 4,5 X Further documents are lasted in the continuation of box C. Y Special categories of cited documents: A' document defining the general state of the art which is not considered to be of particular relevance. E' earlier document but published on or after the international filling date to considered to be of particular relevance. C' document which may throw doubts on priority claim(e) or which is cited to earliethsh the publication date of another citation or other special reason (as specialed) O' document relevance to the claimed invention or other special reason (as specialed) O' document published prior to the international filling date but later than the priority date claimed Islet than the priority date and not entre the continent is taken alone to considered to particular relevance; the claimed invention cannot be considered to envelope an invention of cannot be considered to envelope an invention of cannot be considered to inventi		See Column 6, Time /0 - Time /	5		
A US 3 669 190 A (SIZER ET AL.) 13 June 1972 X Further documents are tisted in the continuation of box C. X Patent family members are based in annex. Ye per document defining the general state of the art which is not considered to be of particular relevance. Ye addition of other paperial reason (as specified) Comment which may throw doubts on priority claim(e) or which is cited to earticlable the publication date of another cited on or other special reason (as specified) Comment published prior to the international filling date but later than the priority date caimed Date of the actual completion of theinternational search 19 October 1998 Verne and maring address of the ISA European Paters Office, P.B. 5618 Patentiaan 2 Authorized officer A L.) 13 June 1972 4,5 Year family members are based in annex. To later document published after the international filling date or priority date and not in conflict with the application but the consideration but problems after the international cannot be considered to undestinated in the comment in the comment in the comment is taken alone or more other auch document is combined on being obvious to a person saddled in the art. Ye document published prior to the international filling date but later than the priority date caimed The comment of particular relevance; the claimed invention cannot be considered to invention alone or more other seach document is combined on being obvious to a person saddled in the art. Ye document member of the same patent family Date of maxing of the international search report 23/10/1998 Authorized officer	A	US 3 353 599 A (SWIFT) 21 Nov	ember 1967	,	
US 3 669 190 A (SIZER ET AL.) 13 June 1972 **The see abstract* **The s		see column 4, line 71 - column	5, line 30	'	
X Further documents are listed in the continuation of box C. X Patent family members are field in annex.	A				
Further documents are listed in the continuation of box C. Year Patent family members are Boled in annex.		see abstract	13 June 1972	4,5	
Further documents are listed in the continuation of box C. Year Patent family members are Boled in annex.					
"Special categories of cited documents: A document defining the general state of the art which is not considered to be of particular relevance. E earlier document but published on or after the international filting date. C document which may throw doubts on priority claim(s) or which is cited to eatablish the publication date of another cited on eatablish the publication of or document referring to an oral disclosure, use, exhibition or other means. B document referring to an oral disclosure, use, exhibition or other means are considered to involve an inventive step when the document is combined with one or more other such document is combined with one or more other such document is combined with one or more other such document at art. Carried to understand the principle or theory underlying the or priority date and not in conflict with the application but cited to understand the principle or theory underlying the or priority date and not in conflict with the application but cited to understand the principle or theory underlying the or priority date and not in conflict with the application but cited to understand the principle or theory underlying the or priority date and not in conflict with the application but cited to understand the principle or theory underlying the or priority date and not in conflict with the application but cited to understand the principle or theory underlying the or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention of accuments of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined to involve an inventive step when the document is combined to involve an inventive step when the document is combined to involve an inventive step when th			-/		
*Special categories of cited documents: A. document defining the general state of the art which is not considered to be of particular relevance considered to be of particular relevance. E' earlier document but published on or after the international filling date L' document which may throw doubts on priority claim(s) or which is cited to earliebish the publication date of another cited ion earliebish the publication date of another cannot be considered to involve an inventive step when the document is combined earliebish the publication document is combined with the application of cannot be considered to involve an inventive step when the document is combined with the application of cannot be considered to involve an inventive step when the document is combined to involve an inventive step when the document is combined to involve an inventive step when the document is combined to involve an inventive step when the document is combined to involve an inventive step when the document is combined to earlie the cannot be considered to involve an inventive step when the document is combined to involve an inventive step when the document is combined to involve an inventive step when					
A document defining the general state of the art which is not considered to be of particular relevance E earlier document but published on or after the international filling date or priority date and not in contrict with the application but citied to understand the principle or theory underlying the invention filling date or priority date document but published on or after the international filling date or priority date document but published on or after the international filling date or priority date date in the publication date of another citied in or other expectal reason (as specified) O document reterring to an oral disclosure, use, exhibition or other means P document published prior to the international filling date but later than the priority date claimed Date of the actual complication of the international search 19 October 1998 Name and maring address of the ISA European Patert Office, P.B. 5618 Patentiaan 2 Name 200 HV Riesouth	χ Funti	her documents are sisted in the continuation of box C.	Patent family members are listed	in annex.	
considered to be of particular relevance e earlier document but published on or after the international filling date 1. document which may throw doubts on priority claim(s) or which a cited to eastablish the publication date of another cited on or other special reason (as specified) 1. document referring to an oral disclosure, use, exhibition or other means 1. document referring to an oral disclosure, use, exhibition or other means 2. document international filling date but later than the priority date claimed 2. document member of the international filling date but later than the priority date claimed 2. document member of the same patent family 2. Date of the actual completion of theinternational search 2. document member of the same patent family 2. Date of mailing of the international search report 2. Authorized officer Authorized officer	' Special ca	tegones of cited documents;	T- lotes dem		
E earlier document but published on or after the international filling date 1. document which may throw doubts on priority claim(s) or which is cited to eastablish the publicationdate of another cited on or other especial reason (as especified) 2. document referring to an oral disclosure, use, exhibition or other means 2. document referring to an oral disclosure, use, exhibition or other means 2. document referring to an oral disclosure, use, exhibition or other means 2. document published prior to the international filling date but later than the priority date claimed 3. document member of the same patent family 2. Date of the actual completion of theinternational search 2. document member of the same patent family 2. Date of maxing of the international search report 2. Authorized officer Authorized officer	'A' docume consid	ent defining the general state of the art which is not			
which is cited to establish the publicationdate of another citedion or other special reason (as specified) O' document reterring to an orat disclosure, use, exhibition or other means P' document published prior to the international filting date but later than the priority date claimed Ode of the actual completion of theiriternational search 19 October 1998 Carried to the international search Date of mailing address of the ISA European Patent Office, P.8. 5818 Patentian 2 N 2290 NV Riswalls.	E" earlier o	focument but published on or after the International		1	
Citation or other special reason (as specified) Or document referring to an oral disclosure, use, exhibition or other means. Price document published prior to the international filting date but later than the priority date claimed Date of the actual completion of theinternational search 19 October 1998 Name and maring address of the ISA European Patrix Office, P.8. 5618 Patentiaan 2 NL -2280 HV Rissouth Yr document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person sidiled in the art. 4.* document member of the same patent family Date of maring of the International search report Authorized officer Authorized officer	L' docume	of which may throw doubte on promise delector -			
O document retarring to an oral disclosure, use, exhibition or other means P* document published prior to the international filing date but later than the priority date claimed Date of the actual completion of theinternational search 19 October 1998 Name and mating address of the ISA European Patert Office, P.B. 5618 Patentian 2 No2280 HV Rissour.	citation	a cred to establish the publication date of another to rother special reason (as specified)	7 Gocument of particular relevance: the	destruction of the second	
Date of the actual completion of the international filing date but 19 October 1998 Name and maring address of the ISA European Patent Office, P.8. 5618 Patentiaan 2 Section of the internation of the international search Authorized officer Authorized officer	Outer 1	TO COLUMN TO COL	document is combined with one or me	ventive step when the	
Date of the actual completion of theinternational search Date of multing of the international search Date of multing of the international search report 23/10/1998 Name and maring address of the ISA European Patent Office, P.8. 5618 Patentiaan 2 Ns2200 HV Rissoult	P* docume	int published prior to the international liling date but an the priority date claimed	in the art.	V3 to a person siglied	
19 October 1998 23/10/1998 Name and making address of the ISA European Patent Office, P.B. 5618 Patentiaen 2 No. 2260 HV Rissouth					
Authorized citicer European Patent Office, P.B. 5818 Patentiaan 2 Nt 2280 HV Rissault			Date of mailing of the International sea	rch report	
Européen Patent Office, P.B. 5816 Patentilean 2 Nt 2280 HV Rissalts	19	9 October 1998	23/10/1998		
European Patent Office, P.B. 5618 Patentinan 2 Ni 2280 HV Ribbudge	Vame and it		Authorized officer		
IBI (A11-70) 240-2040 Tu 24-664		NL · 2280 HV Rimadk			
Fax: (+31-70) 340-3016 Rampelmann, K		Tel. (+31-70) 340-2040, Tx. 31 651 epo ni, Fax: (+31-70) 340-3016	Rampelmann, K		

Form PCT/ISA/210 (second sheel) (July 1992)

INTERNATIONAL SEARCH REPORT

. .rnational Application No PCT/GB 98/02066

Category *	tion) DOCUMENTS CONSIDERED TO BE RELEVANT Citation of document with indexides the second sec		
	Citation of document, with indication, where appropriate, of the relevant passages		Relevant to claim No.
A	METCALFE P: "EXPANDABLE SLOTTED TUBES OFFER WELL DESIGN BENEFITS" PETROLEUM ENGINEER INTERNATIONAL, vol. 69, no. 10, October 1996, pages 60-63, XP000684479 see the whole document		1,6
- 1			
		•	
- 1			
1			
ĺ			
ľ			
	•		
	•		
		1	

INTERNATIONAL SEARCH REPORT

Information on patent family members

Form PCT/ISA/210 (patent tamely sorrest) (July 1992)

PCT/GB 98/02066

Ontone de la companya del companya del companya de la companya de					
Patent document cited in search repor	t 	Publication date	Patent family member(s)	Publication date	
WO 9425655	A	10-11-1994	FR 2704898 A AU 673261 B AU 6660194 A CA 2162035 A CN 1122619 A DE 69412252 D EP 0698136 A JP 8509532 T NO 954299 A US 5695008 A	10-11-1994 31-10-1996 21-11-1994 10-11-1994 15-05-1996 10-09-1998 28-02-1996 08-10-1996 07-12-1995	
US 3746091	A	17-07-1973	NONE		
US 3489220	A	13-01-1970	NONE		
US 3353599	Α	21-11-1967	NONE		
US 3669190	A	13-06-1972	NONE		

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

□ BLACK BORDERS	
☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES	
☐ FADED TEXT OR DRAWING	
☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING	
☐ SKEWED/SLANTED IMAGES	
COLOR OR BLACK AND WHITE PHOTOGRAPHS	
GRAY SCALE DOCUMENTS	
LINES OR MARKS ON ORIGINAL DOCUMENT	
☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY	

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.